

CHLORINE MASTER WORK SHEET

HAZ - MAT PRODUCT WORK SHEET

DATE:	LOCATION:	INCIDENT #:	REFERENCE:	PAGE #
PRODUCT NAME: Chlorine		TRADE NAME:	SYNONYMS: Bertholine/Molecular Chlorine	
UN HAZARD CLASS # Poison Gas I.D. # 1017		CAS # 7782-50-5		
L.P.A. REG #		E.P.A. EST #	STCC # 4920523	
CHEMICAL PROPERTIES		NFPA 7-0-4		
BOILING POINT: -29 ° F		H: 3	SOLID: LIQUID: X CAS: X	OTHER: Greenish - Yellow
FLASH POINT: Non-combustible		F: 3	VAPOR: DUST:	
IGN TEMP Non-combustible		R: 0	MANUFACTURER:	
FLAMMABLE RANGE:		SPECIAL: Oxidizer	SHIPPER:	
SPECIFIC GRAVITY: 1.424 at 59 ° F			CARRIER:	CONTAINER TYPE:
VAPOR DENSITY: 2.45			VEHICLE I.D. #	
WATER SOLUBILITY: Slightly Soluble			DECON SOLUTION: Soapy Water (copious amounts)	
EXPANSION RATIO:				
PROTECTIVE EQUIPMENT: Level A Encapsulated				
EPA LEVEL: A				
RECOMMENDED MATERIAL: Neoprene, PVC, Viton, Chlorinated Polyethylene				
EXTINGUISHING EQUIPMENT: Small fires let burn/large fires flood with water or fog. Do not use Carbon Dioxide, Halon, or Dry Chemical				
Can cause BLEVES in enclosed containers				
FIRST AID: Remove victim from contaminated atmosphere, remove & isolate clothing, flush exposed eyes with water 15-30 minutes.				
Decon skin by washing with soapy water, give O ₂ , monitor for shock				
HEALTH HAZARDS: Irritant to lungs, eyes, mucus membranes, and skin. Severe exposure may be fatal.				
Hydrochloric Acid will form when chlorine contacts moist tissue.				



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Material Safety Data Sheets Collection:

Sheet No. 53
Chlorine

Issued: 7/79

Revision: C, 9/92

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Section 1. Material Identification

Chlorine (Cl₂) Description: Widely distributed in nature but not as a free gas due to its high reactivity. It forms 0.15% of the earth's crust mostly as sodium chloride in sea water and natural deposits as carnallite and sylvite. Commercially produced mainly by diaphragm or mercury cell electrolysis of sodium chloride in brine solution. Mercury cell electrolysis produces purer results but is more expensive and presents a mercury vapor health hazard that the diaphragm cell does not. Also prepared in the lab from manganese oxide and hydrogen chloride or by the 'kelo-chlor' process (oxidation of hydrogen chloride with nitrogen oxide as a catalyst and absorption of steam with sulfuric acid). Used as a disinfectant, oxidizing or chlorinating agent; in bleaching, purifying water and sewage, shrink-proofing wool, detinning and dezincing iron, flame-retardant compounds, special batteries (with zinc or lithium), processing food, and the manufacture of plastics, chlorinated organic chemicals, refrigerants, pesticides, and polymers.

Other Designations: CAS No. 7782-50-5, Bertholite, molecular chlorine.

Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*⁽⁷³⁾ for a suppliers list.

R 2 NFPA
I 4
S 3
K 1
HMIS
H 3
F 0
R 0
PPE*
* Sec. 8

Cautions: Chlorine is a strong oxidizer and although noncombustible, it supports combustion of other materials. It is highly irritating and corrosive and can be fatal above 1000 ppm after only a few breaths. Use extreme caution around chlorine gas and its compressed liquid.

Section 2. Ingredients and Occupational Exposure Limits

Chlorine; industrial grade (99.3%, research grade (99.99%). Impurities are traces of bromide, hexachloroethane, hexachlorobenzene, and water.

1991 OSHA PELs

8-hr TWA: 0.5 ppm (1.5 mg/m³)
15-min STEL: 1 ppm (3 mg/m³)

1990 IDLH Level

30 ppm

1990 NIOSH RELs

8-hr TWA: 0.5 ppm (1.5 mg/m³)
15-min STEL: 1 ppm (3 mg/m³)

1992-93 ACGIH TLVs

TWA: 0.5 ppm (1.5 mg/m³)
STEL: 1 ppm (2.9 mg/m³)

1990 DFG (Germany) MAK

Ceiling: 0.5 ppm (1.5 mg/m³)
Category 1: local irritant
Peak Exposure Limit: 1 ppm, 5 min
momentary value, max of 8/shift

1985-86 Toxicity Data*

Human, inhalation, LC₅₀: 500 ppm/15 min; no toxic effect noted
Human, inhalation, LC₅₀: 2530 mg/m³/30 min caused a change in the trachea or bronchi, emphysema, and chronic pulmonary edema or congestion.
Human, lymphocyte, cytogenic analysis: 20 ppm was mutagenic.

* See NIOSH, RTECS (FO2100000), for additional mutation and toxicity data.

Section 3. Physical Data

Boiling Point: -29 °F (-34 °C)
Freezing Point: -150 °F (-101 °C)
Vapor Pressure: 6.3 atm at 68 °F (20 °C)
Vapor Density (Air = 1): 2.45
Refraction Index: 1.0008 (gas), 1.367 (liquid)
Viscosity: 0.385 cP at 32 °F (0 °C)

Molecular Weight: 70.906
Density: Liquid, 1.4085 at 68 °F (20 °C) and 6.864 atm; 1.56 at -30.28 °F (-34.6 °C)
Water Solubility: Slightly soluble, 0.7% (reacts to form corrosive hydrochloric acid & vapors).
Other Solubilities: Soluble in alkalis, alcohols, and chlorides.
Odor threshold: 0.08 to 0.4 ppm*
Other: L (liquid) = 456.8 L (gas) at 32 °F (0 °C) and 1 atm

Appearance and Odor: Greenish-yellow gas with a suffocating odor at room temperature, condenses to amber liquid at -34 °C or at high pressure, and forms rhombic crystals at -150 °F.

* Odor is not considered a good warning property for prolonged exposure because of olfactory fatigue.

Section 4. Fire and Explosion Data

Flash Point: Noncombustible Autoignition Temperature: Noncombustible LEL: None reported UEL: None reported

Extinguishing Media: Chlorine is noncombustible, but most combustibles will burn in chlorine gas as they do in oxygen. Contain small fires and let burn. For large fires, flood with water or fog. Do not use carbon dioxide or Halon. **Unusual Fire or Explosion Hazards:** Cylinders may vent rapidly or explode in heat of fire. Chlorine presents a vapor explosion hazard indoors, outdoors, and in sewers. **Special Fire-fighting Procedures:** Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Structural firefighter's protective clothing is not effective for fires involving chlorine. Use water spray to cool containers until well after fire is out. Stay away from ends of tanks. For massive fire in cargo area, use monitor nozzles or unmanned hose holders; if impossible, withdraw and let fire burn. Do not release runoff from fire control methods to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Chlorine is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur. Elevated temperatures may cause cylinders to burst. **Chemical Incompatibilities:** Most finely divided metals, combustibles, organic materials, moisture, water, steam, and the following chemicals: acetylene, alcohols, ammonia, arsenic, bismuth, boron, benzene, calcium, activated carbon, carbon disulfide, ether, ethane, ethylene, fluorine, glycerol, hydrazine, hydrocarbons, iodine, methane, oxomonoisilane, potassium, polypropylene and silicon, and attacks some forms of plastics, rubber, and coatings). Because Cl₂ is incompatible with many materials, check compatibility of needed materials before proceeding with a procedure. **Conditions to Avoid:** Exposure to heat, moisture, and incompatibles. **Hazardous Products of Decomposition:** Thermal oxidative decomposition of chlorine can produce toxic products.

Section 6. Health Hazard Data

Carcinogenicity: The IARC,⁽¹⁶⁴⁾ NTP,⁽¹⁶⁹⁾ and OSHA⁽¹⁶⁴⁾ do not list chlorine as a carcinogen. **Summary of Risks:** Chlorine gas reacts with body moisture to form corrosive hydrochloric acid. Vapor inhalation is irritating at low levels and at high concentrations acts as an asphyxiant by causing cramps in the larynx muscles and mucous membrane swelling. In one case of exposed workers, obstructive and restrictive abnormalities were observed with most clearing in 3 months but symptoms remaining in others. Insufficient evidence exists to prove potential for permanent damage in survivors of severe exposures; prolonged symptoms may be due to aggravation of pre-existing conditions. **Medical Conditions Aggravated by Long-Term Exposure:** Asthma, heart disease, chronic obstructive pulmonary disease. Note that pulmonary edema (fluid in lungs) can cause lung scarring and permanent disability. **Target Organs:** Eyes, respiratory and central nervous systems, teeth, and skin (liquid). **Primary Entry Routes:** Inhalation, eye and skin contact.

Continue on next page

Section 6. Health Hazard Data, continued

Acute Effects: Inhalation of low levels can cause eye, nose, and throat irritation, sneezing, copious salivation, general excitement, and restlessness. Higher concentrations lead to rales, difficulty breathing, violent coughing, nausea, vomiting, cyanosis, dizziness, headache, choking, laryngeal edema, acute tracheobronchitis, chemical pneumonia. Death usually results from cardiac and respiratory failure from pulmonary edema (fluid in lungs), and ensuing cessation of circulation and breathing from lack of blood flow to the brain causing cerebral tissue anemia. Compressed gas from leaking cylinders can cause smarting and 1st degree skin burns on short exposure or 2nd degree burns on prolonged exposure. Frostbite may also occur. Liquid contact with the eye may result in conjunctivitis and corneal burns. **Chronic Effects:** Tooth enamel corrosion, skin eruptions 'chlor-acne', coughing, severe chest pain, sore throat, hemoptysis (spitting up blood from the respiratory tract) and increased susceptibility to tuberculosis.

FIRST AID

Eyes: Do not allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately. **Skin:** Quickly remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. For reddened or blistered skin, consult a physician. For frostbite, immerse affected area in 107 °F (42 °C) water until completely rewarmed. Do not use dry heat! **Inhalation:** Remove exposed person to fresh air and administer 100% humidified oxygen. **Ingestion:** Highly unlikely! Chlorine is only at liquid below -29 °F (-34 °C) or at elevated pressures. **Note to Physicians:** Monitor arterial blood gases in moderate to severely symptomatic patients to ensure adequate ventilation.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Immediately notify safety personnel, isolate and ventilate area, deny entry, and stay upwind. Remove all combustibles from leak area. Use water spray to cool and disperse vapors. Be aware that runoff is hazardous and must be contained. Neutralize runoff with caustic soda or soda ash and await reclamation or disposal. Cleanup personnel should wear fully-encapsulating, vapor-protective clothing. For small leaks, evacuate 900 ft in all directions and protect persons downwind for 3 miles. For large leaks, evacuate in all directions for 1500 ft and protect persons downwind for 5 miles. Report any release in excess of 10 lb. Follow applicable OSHA regulations (29 CFR 1910.120). **Ecotoxicity Values:** Chlorine gas destroys vegetation. Grass shrimp, TLm = 0.22 mg/L/96 hr; coho salmon, LC₅₀ = 208 mcg/L/1 hr; yellow perch, LC₅₀ = 0.88 mg/L/1 hr; rainbow trout, TLm = 0.08 mg/L/168 hr. **Environmental Degradation:** Chlorine is not stable in water. It rapidly oxidizes inorganic compounds and slowly oxidizes organic compounds. It reacts with organic precursors found in many source waters to produce potential carcinogens such as chloroform. **Disposal:** Add waste chlorine to large volume of reducing agent (i.e. bisulfite or ferrous salt), neutralize (do not use sodium hydroxide as a neutralizing agent-- a 20% solution + Cl₂ caused an explosion), and flush to sewer. Recovery is an option for chlorine gas produced from aluminum chloride electrolysis and chlorine in waste water. Used in manufacture of HCl or other chlorine containing chemical. If not an option, bind the escaping chlorine gas with a lime scrubber to prevent its release to the outside. For in situ amelioration, dechlorinate with sodium thiosulfate. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

Listed as a SARA Extremely Hazardous Substance (40 CFR 355), TPQ: 100 lb
Listed as a SARA Toxic Chemical (40 CFR 372.65)

Listed as a CERCLA Hazardous Substance* (40 CFR 302.4): Final Reportable
Quantity (RQ), 10 lb (4.54 kg) [* per CWA, Sec. 311 (b)(4)]

Listed as a RCRA Hazardous Waste (40 CFR 261.23): No. D003, Characteristic of reactivity (criteria 4)

OSHA Designations

Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Listed as a Process Safety Hazardous Material (29 CFR 1910.119), TQ: 1500 lb

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy. **Respirator:** Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. For < 5 ppm, use any chemical cartridge respirator with protection against Cl₂. For < 12.5 ppm, use any supplied-air respirator (SAR) operated in continuous-flow mode or any powdered air-purifying respirator (PAPR) cartridges providing protection against Cl₂. For < 25 ppm, use any SCBA or SAR with a full facepiece or any PAPR with a tight fitting facepiece and cartridges providing protection against Cl₂, or any chemical cartridge respirator with protection against Cl₂. For < 30 ppm, use any SAR with a full facepiece operated in pressure demand or other positive pressure mode. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. **Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.** If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas. **Other:** Wear chemically protective gloves, boots, aprons, and gauntlets to prevent skin contact. Butyl rubber (good for gas not liquid) and Viton with breakthrough times (BT) of > 8 hr, fluorocarbon rubber and teflon with BT's > 4 hr, polycarbonate and chlorinated polyethylene are suitable materials for PPE. **Ventilation:** Provide general and local exhaust ventilation systems to maintain airborne concentrations below the OSHA PELs (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.⁽¹⁰³⁾ **Safety Stations:** Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities. **Contaminated Equipment:** Separate contaminated work clothes from street clothes and launder before reuse. Remove this material from your shoes and clean personal protective equipment. **Comments:** Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Prevent physical damage to containers. Store in a cool, dry, well-ventilated area away from direct sunlight, flammable, incompatibles, and moisture, and on a cement floor sloping towards a drain capable of collecting all the liquid in the cylinders. This drain should not be used for water drainage. Outside or detached storage is preferred. Secure protective valve covers when cylinder is empty. Use only auxiliary valves and gauges designed solely for chlorine gas. Check for leaks daily. **Engineering Controls:** To reduce potential health hazards, use sufficient dilution or local exhaust ventilation to control airborne contaminants and to maintain concentrations at the lowest practical level. Purge all equipment and pipelines beginning repairs. Do not clean equipment with alcohol or hydrocarbons (incompatible with chlorine). Keep emergency repair kits available. Make sure any opening cylinders are free of dust, dirt, and grease. **Administrative Controls:** Consider preplacement and periodic medical exams of exposed workers emphasizing the skin, eyes, teeth, and respiratory system. Install and monitor automatic warning systems to detect the presence of chlorine gas.

Transportation Data (49 CFR 172.101)

DOT Shipping Name: Chlorine

DOT Hazard Class: 2.3

ID No.: UN1017

DOT Label: Poison Gas

DOT Packing Group: --

Special Provisions (172.102): 2, B9, B14

Packing Authorizations

a) Exceptions: --

b) Non-bulk Packaging: 173.304

c) Bulk Packaging: 173.314, 173.315

Quantity Limitations

a) Passenger, Aircraft, or Railcar: Forbidden

b) Cargo Aircraft Only: Forbidden

Vessel Stowage Requirements

a) Vessel Stowage: D

b) Other: 40, 51, 55, 62, 68

MSDS Collection References: 26, 73, 100, 101, 103, 124, 126, 127, 132, 133, 136, 139, 140, 148, 149, 153, 159, 163, 164, 167, 168, 171, 176, 180

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